10/566289

WO 2005/021808 IAP20 Rec'd PCT/PTO 27 JAN 2006

METHOD FOR THE PYROMETALLURGICAL PRODUCTION OF COPPER IN A CONVERTER

DESCRIPTION

The invention relates to a method for the pyrometallurgical production of copper in a converter.

In the pyrometallurgical production of so-called blister copper, copper matte and/or secondary raw materials, for example, are used as raw materials. The aim is to produce the so-called blister copper in a purity of at least 96 wt. %, preferably over 99 wt.%. An attempt is of course made to achieve degrees of purity that lie as close as possible to 100 wt.%.

An essential part of this copper production consists in the so-called "conversion" in a converter. Such converters are known by the name Pierce Smith and Hoboken.

For this converter treatment, a copper-containing melt is first filled into the converter (charged into the converter).

In the next treatment step, foreign components, especially iron sulphide, are removed as far as possible, or more precisely converted into a slag. This process, which is also referred to as "slagging", has the purpose of purifying the copper melt to an extent such that the latter very predominantly consists only of Cu_2S (also referred to as "white metal").

"Slagging" includes the subsequent removal of the slag from the converter.

In order to make blister copper from the Cu_2S, secondary metallurgical methods are known in which a gas, in

particular oxygen, is blown into the melt (US 4,830,667). Sulphur and other foreign substances, nickel for example, are thereby removed as far as possible. It can be deduced from US 4,830,667 A that a nickel content of over 1.0 wt.% is undesirable.

Finally, the blister melt thus formed is removed from the converter.

This method is widely used, but has several drawbacks. For example, the slag usually has to be removed through the charging opening of the furnace during "slagging". This gives rise to the risk of valuable copper melt being lost. The method lasts for a relatively long time if the stated high degree of purity is to be obtained.

The aim of the invention is to optimise the known method. Copper production should be possible either in a shorter time and/or with a higher degree of purity.

The invention proceeds from the following consideration: during the filling (charging) of the converter, no metallurgical work is performed in the reactor. The furnace serves merely as a "buffer" or as a "holding unit". This also applies to the last process step, in which the melt is emptied from the converter.

According to the invention, these process steps are also used for the secondary metallurgical treatment of the melt. In other words, a treatment gas is already introduced into the metal melt (copper melt) during charging of the converter. This has the advantage that the so-called "slagging" step commences virtually at the same time as the charging and not until after a time delay. The converter can be used from the first second in the sense of a melt treatment.

This applies up to the point at which the melt is removed from the converter.

A rinsing treatment during the "deslagging" has the advantage that the removal of foreign components and the formation of the slag are accelerated.

In this process step, the gas purging/rinsing treatment can be used for another effect. By means of a selective motion of the metal bath, the slag can be guided selectively in the direction of the converter opening, where it is then drawn off. A more precise segregation between slag on the one hand and melt on the other hand is thus achieved and the loss of melt observed in the prior art is avoided.

Accordingly, the invention relates in its most general embodiment to a method for the pyrometallurgical production of copper in a converter, with the following features:

a) charging of the converter with copper-containing melt,
b) treatment of the melt in such a way that foreign components are converted into a slag, until the melt predominantly consists solely of Cu_2S,
c) removal of the slag from the converter,
d) blowing of gas into the Cu_2S-containing melt in order to establish a largely pure copper melt by removal of sulphur,
e) emptying of the converter into a downstream unit, whereby
f) gas is also introduced into the respective melt during process steps a), b), c) and e).

The gas used in process steps a), b), c) and e) can consist predominantly or completely of oxygen like the gas used in process step d). Other gases, including inert gases, are also possible.

At the end of process step d), the fraction of oxygen can be reduced in a selective manner and replaced by a fraction of inert gas. The fraction of oxygen can initially amount well above 50 %, whilst the fraction of inert gas towards the end of this process step amounts to over 50 %. In this way, the fraction of copper(I)oxide can be minimised. The inert gas treatment can be continued in process step e).

The actual conversion process in process step d) can be represented chemically as follows:

$$2Cu_2S + 3O_2 \Rightarrow 2Cu_2O + 2SO_2$$
$$2Cu_2O + Cu_2S \Rightarrow 6Cu + SO_2.$$

The emptying of a converter with 300 tonnes of blister copper takes approximately one hour. According to the invention, the metal melt should also be acted upon (treated) during this emptying stage. The secondary metallurgical treatment of the copper melt can thus be conducted over the whole conversion process.

The feeding of the gas (the gases) can take place via a plurality of gas purging/rinsing elements. Such gas purging elements (gas rinsing bricks) have been known for decades especially from the treatment of steel melts. Such gas purging elements can be readily adopted according to the invention. Gas rinsing elements with directed porosity as well as those with non-directed porosity can be used. The first group is characterised in that more or less rectilinear slits or channels are formed in the rinsing elements, through which the gas is conveyed. Gas rinsing elements with non-directed porosity are designed like a "sponge". The gas must move through the body from pore to pore.

Such gas purging elements (or also nozzle-type gas rinsing elements) can be used individually or in groups in the bottom and/or the wall of the converter. According to the invention, provision is made such that they can be activated individually, in preselectable groups or all together. Again, individual gas rinsing elements or groups of gas rinsing elements can be charged with a different gas or different gas pressure.

Preferably, a suitable gas regulator is provided for this purpose. The latter can be adjusted so as to set the metal melt into a motion which is such that the slag floating thereon acquires a specific flow direction, for example in the direction of the tapping opening.

The method can be conducted in such a way that gas(es) is introduced into the melt (blown in, jetted in) during all the treatment steps and uninterruptedly.

Both the gas and the gas quantity and/or gas pressure can be changed during the individual treatment steps.

In a converter which can accommodate for example 300 tonnes of copper blister, 10 gas rinsing elements can for example be provided, each with a rinsing rate of for example 200 litres per minute.

The method enables greatly accelerated pyrometallurgical copper production with a degree of purity which at least corresponds to the degree of purity according to the prior art and can lie well above 99.5 wt.%.